Control Mechanisms in Developmental Processes

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Foreword

In 1939, N. J. Berrill introduced the first symposium of the Society with the words:

> "Biologists are finding themselves increasingly perplexed by the lack of an adequate conceptual framework with which to guide their own investigations and to bring the results of many specialized studies into a more coherent and meaningful relationship.
>
> "With this need in view, a Symposium on 'Development and Growth' sponsored by the Editors of 'Growth' was held at North Truro, Mass., from August 7th to 11th, 1939. Sessions were held each morning and afternoon, each beginning with a paper lasting about one hour and followed by unhurried discussion and comment."

Over the years the Society has striven to maintain an unhurried atmosphere at the meetings, in part by publishing the papers so that members can listen with the assurance that the printed word will soon assist their memories.

From this beginning the Society for Developmental Biology has emerged to represent the multidisciplined field originally covered by "Development and Growth." After a varied history we now once again have both a journal and an annual symposium volume. To cement the Society's association with its journal, *Developmental Biology,* yet more firmly, all future symposia will be published as annual supplements.

History of the Symposium Volumes

No.	Held	Title	Editor	Publisher
1	Aug. 1939	Development and Growth	Editors of *Growth*	Supplement to Vol. 1, 1939
2	June 1940	Development and Growth	Editors of *Growth*	Supplement to Vol. 2, 1940
3	July 1941	Development and Growth	Editors of *Growth*	Supplement of Vol. 5, 1941
4	Aug. 1942	Development and Growth	Editors of *Growth*	Supplement of Vol. 6, 1942
5		1945 Not published		
6	Aug. 1946	Perspectives in Development and Growth	Editors of *Growth*	Supplement of Vol. 10, 1946
7	Aug. 1947	Published as Volume 11, No. 4, 1947, of *Growth*		
8	Aug. 1948	Development and Growth	Editors of *Growth*	Supplement of Vol. 12, 1948
9	Aug.–Sept. 1949	Development and Growth	Editors of *Growth*	Supplement of Vol. 13, 1949
10	Aug.–Sept. 1951	Development and Growth	Editors of *Growth*	Supplement to Vol. 15, 1951
11	June 1952	Dynamics of Growth Processes	E. J. Boell	Princeton Univ. Press, 1954
12	June 1953	Biological Specificity and Growth	E. G. Butler	Princeton Univ. Press, 1955
13	June 1954	Aspects of Synthesis and Order in Growth	Dorothea Rudnick	Princeton Univ. Press, 1954
14	June 1955	Cellular Mechanisms in Differentiation and Growth	Dorothea Rudnick	Princeton Univ. Press, 1956
15	July 1956	Rhythmic and Synthetic Processes in Growth	Dorothea Rudnick	Princeton Univ. Press, 1957
16	June 1957	Developmental Cytology	Dorothea Rudnick	Ronald Press, 1959
17	June 1958	Cell Organism and Milieu	Dorothea Rudnick	Ronald Press, 1959
18	June 1959	Developing Cell Systems and Their Control	Dorothea Rudnick	Ronald Press, 1960
19	June 1960	Synthesis of Molecular and Cellular Structure	Dorothea Rudnick	Ronald Press, 1961

20	June 1961	Regeneration	Dorothea Rudnick	Ronald Press, 1962
21	June 1962	Cytodifferentiation and Macromolecular Synthesis	Michael Locke	Academic Press, 1963
22	June 1963	Cellular Membranes in Development	Michael Locke	Academic Press, 1964
23	June 1964	The Role of Chromosomes in Development	Michael Locke	Academic Press, 1964
24	June 1965	Reproduction: Molecular, Subcellular, and Cellular	Michael Locke	Academic Press, 1965
25	June 1966	Major Problems in Developmental Biology	Michael Locke	Academic Press, 1966

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DEVELOPMENTAL BIOLOGY SUPPLEMENT 1, 1–31 (1967)

I. THE ROLE OF CYTOPLASMIC UNITS

Control Mechanisms in Plastid Development

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INTRODUCTION

The metabolic activity of the plastid which is of greatest significance to the organism as a whole is photosynthesis, including the capture of light energy, its conversion to electrochemical energy, and the storage of this energy in carbon bonds. Thus, the chloroplast does photochemistry, electron transport, and carbon metabolism in the course of carrying out its photosynthetic activities. Precisely what the plastid does strictly for its own development and maintenance is more difficult to define. This discussion will deal primarily with chemical changes during the development of plastids in leaves of higher plants.

When full-grown the saucer-shaped chloroplasts in leaves of higher plants are approximately 10 μ across and 5 μ thick. Within the limiting membrane of such a plastid in maize (Fig. 1) is the lamellar system including the grana, which are composed of stacks of vesicles. The grana are interconnected in a complex manner. Outside the grana is the "stroma" region. A number of different kinds of studies, including examination by the freeze-etching technique (Mühlethaler, 1966; Park and Branton, 1966) and by low angle X-ray diffraction (Menke, 1966), indicate that the lamellae are made up of subunits. Within the stroma are ribosomes as well as strands of DNA (for discussion see, e.g., Bogorad, 1967) and many kinds of molecules that are too small to see.

It can be shown in a most elementary way that the photosynthetic pigments, the chlorophylls, are localized in the lamellar structure of the chloroplasts. Plastids are osmotically sensitive and can be liberated from the cell in media containing 0.5 *M* sucrose; they can be purified by differential or gradient centrifugation; and they can be ruptured by

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